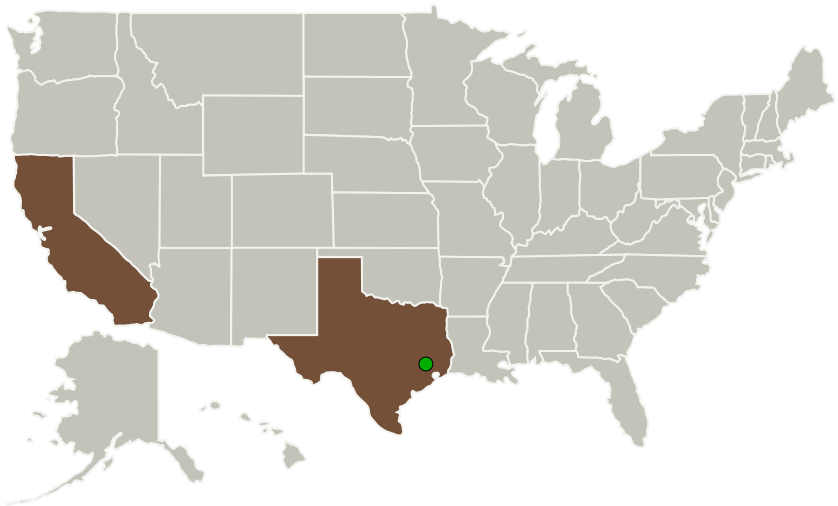
Miniature Sensor Probe for O2, CO2, and H2O Monitoring in Space Suits, Phase I

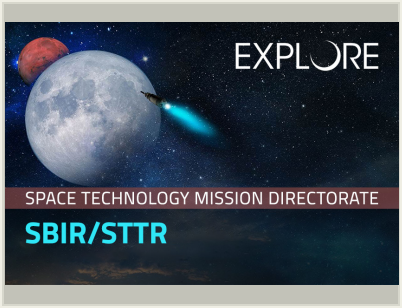
Completed Technology Project (2012 - 2012)

Project Introduction

Advanced space suit technologies require lightweight, low-power, durable sensors for monitoring critical life support constituents. Current technology cannot provide the compact sensors with a tolerance for liquid water that are specifically requested for next-generation portable life support systems (PLSS). Intelligent Optical Systems (IOS) proposes to develop a luminescence-based optical sensor suite to monitor carbon dioxide, oxygen and humidity. Optical sensors are superior to electrical sensors, in terms of robustness, reliability and maintenance. These advantages are most notable in moist environments. Our monitor will incorporate robust sensors for carbon dioxide, oxygen, and humidity partial pressure, interrogated using a compact, low-power optoelectronic unit. The proposed sensors will not only tolerate liquid water but will actually operate while wet, and can be remotely connected to the electronic circuitry by an electromagnetic interference (EMI)-proof optical fiber cable. For space systems control, miniature fiber optic sensors connected to the electronic circuitry by an optical fiber cable allow greater flexibility in placing the sensor in highly constrained volume systems such as PLLS. Our flow-through monitor will include a 1 mm diameter optical sensor we are currently developing for PLSS humidity monitoring and an optical oxygen sensor that uses similar IOS technology. Building on this work, in the proposed Phase I, IOS will develop and demonstrate a carbon dioxide sensor based on the same approach, and a prototype PPCO2-H2O-O2 sensor probe will be fabricated and tested in relevant environmental conditions. In Phase II, we will manufacture prototypes for space qualification and conduct extensive testing under simulated environmental conditions culminating in validation in NASA systems, bringing the monitor to TRL 7.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
Intelligent Optical Systems, Inc.	Lead Organization	Industry	Torrance, California
Johnson Space Center(JSC)	Supporting Organization	NASA Center	Houston, Texas

Primary U.S. Work Locations	
California	Texas

Project Transitions

February 2012: Project Start

August 2012: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140311)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Intelligent Optical Systems, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Jesus D Alonso

Co-Investigator:

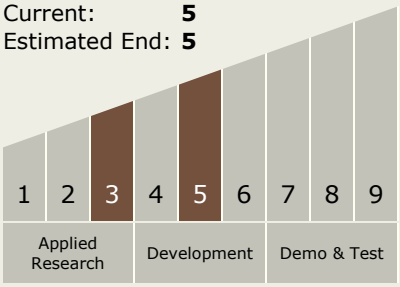
Jesus Delgado Alonso

Miniature Sensor Probe for O2, CO2, and H2O Monitoring in Space Suits, Phase I

Completed Technology Project (2012 - 2012)

Technology Maturity (TRL)

Start: **3**
Current: **5**
Estimated End: **5**



Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
  - TX06.2 Extravehicular Activity Systems
    - TX06.2.2 Portable Life Support System

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System